POST-WAR PROBLEMS OF THE INDIAN LAC INDUSTRY

BY

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ALL indigenous products, agricultural, mineral and sylvan, have lost their foreign markets at the present moment, to a smaller or greater degree, and this has imposed a necessity for a review of the situation both during the war and after. In certain cases, the present difficulties have been a blessing in disguise in so far as they have provided an incentive for the development of industries in this country to produce out of the indigenous raw materials substitutes for many imported commodities. There is a great apprehension that some of these industries which the war has brought into existence will disappear at the cessation of hostilities, especially in cases where the present developments are based on uneconomical foundations. But one can safely assume that some at least of the many industries will survive and cater to the post-war needs of India. It can be assumed further that an improved standard of living, not improbable as a result of the war, will also contribute to the continuance of industries based on the proper utilisation of raw products in this country, and the most ideal position will be to so far improve the industries as to be able to create a certain amount of export market after the internal needs are met. Then again, it is extremely probable that at the end of the present war, under a new order of things, there would be certain large-scale basic industries in India, which would bring in their train several accessory industries. Industrial production of war materials will naturally decrease, but it would be difficult to imagine that some of them at least would not be capable of being turned over to the production of peace-time requirements, with a minimum of dislocation as regards plant and equipment. One hopes, at any rate, that a country like India, which as yet is not adequately industrially developed, and as such differentiates itself from the already fully industrialised counntries, would require every machine and plant installed during the present crisis for meeting her future industrial needs; this expansion will be aided also by the large number of technically trained personnel that will be released all of a sudden at the end of the war. It may be hoped, therefore, that the nightmare of a slump after the war may end in a pleasant and fruitful industrial awakening of the country.

Another view-point, which may be stressed in this connection, is that under existing world conditions it is absolutely essential in the interests of any country to organise its industries in such a way that, in case of aggression from other nations, it can always have the necessary potential for large-scale armament production. In this respect India had been woefully deficient in the past and to secure and maintain a position of safety, such new industries will have to be permanently established. It would be reasonable, therefore, to expect that certain war industries brought into being due to the present emergency would continue as such, though on a reduced scale and, if necessary, develop to a larger extent, so as to have the necessary provision for self-defence, although it may be felt that no country's peace is worth the name excepting in a comity of nations. It will be unwise to overlook that a minimum of war industries would always be a matter of national safeguard.

So far, India may be regarded mainly as an agricultural country without a proper agricultural industry. The by-products of agriculture and forestry would constitute raw materials for various industries and in this region lies the need for extensive theoretical and technical researches to be able to successfully utilise them. This would enable the country to minimise, if not altogether stop, the import of manufactured products based on natural or synthetic materials. The acid test will, however, always be whether indigenous manufacture could be effected at an economic level to face external competition. The position of lac is rather peculiar in that it is not a by-product but a raw material which has been in demand all over the world for the fabrication of many industrial articles. Whilst the use of the lac-dye (which was the main ingredient for which lac was appreciated in the past) has practically disappeared with the advent of synthetic dyes, the value of the lac resin itself has been recognised for more than forty years in certain specific industries where the synthetic resin has not as yet been able to make any substantial headway. The extraordinarily rapid development of the synthetic resin industry in foreign countries has not, however, created a fall in the demand for shellac as will be noticed from Table I.

Thus lac exported into foreign countries has been more than able to hold its position in the industries in which it was being used. And this, in spite of the fact that chemists by the hundred had been systematically exploring the possibilities of synthetic resins in various laboratories in the world during the period 1910-1926, when only occasional and small-scale researches were being carried out on lac. To mention only one example, more than 230 chemists and engineers were at one time or another engaged on the development of Nylon, the synthetic resin fibre, the total annual output of which is to-day about 7,000 tons. An inference may be drawn, therefore, that the position of lac after the present war will continue to be at least as good as before, if not better, on account of the very intensive research that is being lately carried out to find out newer uses of this resin.

The idea that every raw material or by-product should be fully exploited in the country

TABLE I

Exports of Lac (Crude and Refined) from India

Year	Weight	Value (Rupees in thousands)	Calculated price per cwt.
Pre-war average—	Cwt.	RS.	RS. A. P.
1909–10 to 1913–14	434,351	22.015	54- 1- 9
War average—			
1914–15 to 1918–19	345,376	25,706	74- 6- 9
Post-war years			
1921—22	434 934	79,158	198–11- 3
1922—23	476,011	102,562	242- 0- 7
1923—24	485,671	90,627	203- 3- 0
1924—25	427,017	75,506	191- 3- 4
1925—26	539,924	69,010	138- 5- 3
1926—27	592,030	54,724	101–12- 3
1927—28	543,584	69,886	140- 9- 9
1928—29	743,403	86,426	128- 6–10
1929—30	668,914	69,672	113–13–10
1930—31	547,151	31.374	62- 6- 5
1931—32	463,724	18,394	43–11- 6
1932—33	418,300	12,424	31–13- 6
1933—34	730,545	24.624	33–11- 2
1934—35	585,194	33,110	56- 9- 3
1935—36	487,801	15,828	32- 7- 2
1936—37	836,405	23,494	28- 1- 5
1937—38	665,525	16,198	24- 5- 5
1938—39	642,054	12,639	19–10–10
1939—40	760,399	19,119	25- 2- 3
1940—41	597,864	22,543	37- 1- 1
1941—42	766,707	49,208	64- 2–10

of its origin, supported, if need be, by public and State patronage, is not as widely appreciated as it should be. Nor is there as much planning as is desirable for co-ordinating production of the same article by alternative methods. To secure the highest economic value of national industries, not only a good deal of adjustment on a wide scale and in details within the country is necessary but even the putting up of a temporary, high tariff-wall against foreign imports should not be stigmatised as a retrograde step. To face the competition of synthetic resins, industries based on lac must needs be carefully and almost affectionately protected during the earlier stages of their development.

The position of the shellac industry after the war has often been a subject of enquiry at the Indian Lac Research Institute. Whilst at the present moment an internal consumption of shellac to the tune of 33 per cent. of the total produce has been claimed by some authorities, there is no doubt that the pre-war figure of 2-3 per cent. home consumption has been very much exceeded and the demand for shellac still continues. This increased consumption is due to the establishment of several new industries in the country, which were hitherto unknown, as a result of researches carried out by the Indian Lac Cess Committee, the Board of Scientific and Industrial Research, and the Indian Institute of Science, Bangalore. Amongst the new materials may be mentioned a dressing for anti-gas fabrics, "windolite" varnish, laminated paper and jute boards, water-proof abrasive papers, water-proof book-binding cloth, bobbin enamels, shellac moulding powders—both injection and compression—emery grinding wheels, non-shattering petrol containers, artificial leather-cloth, insulating varnishes, plywood adhesives, enamels and lacquers for various metallic surfaces, radio parts, etc. If one scans this list, he would have scarcely any hesitation in concluding that excepting the consumption in anti-gas fabrics, the others would be permanent industries after the war, consuming a very considerable quantity of shellac in their manufactures. Thus, for example, the moulding industry for general purposes alone may consume as much as 1,000 tons of lac or 2,000 tons of Kiri, a by-product in the shellac industry; lac recovered from Kiri would cost only Rs. 10-12 per maund, a figure which can scarcely be approached by synthetic resins. This is the least quantity that one can reasonably think of, but there is every possibility that with an improved standard of living and a desirable economy in the conservation of metals, plastics from shellac would claim a larger and still larger share in the economy of life, provided also that intensive researches to better the properties of this unique resin are continued.

The economic aspect of shellac plastics should not be lost sight of to appreciate its future possibilities. Under normal conditions, shellac moulding powders could be produced at 2½-3½ annas per pound, whilst no powder based on a synthetic resin could be fabricated under twice that cost. As further researches are brought to bear on this problem, there could be no doubt that improvement in properties would ensue and popularity of shellac plastics would increase.

An industry of singular value and potentiality can be envisaged in laminated boards of paper and jute, the latter being an important Indian industry, the waste from which could serve as a raw material to be bonded with adhesives developed from shellac. The significance of shellac adhesives in their application in plywood industry cannot be overestimated, and recent researches at the Indian Lac Research Institute show excellent promise of a lac-*cum*-synthetic of high elasticity and toughness, the use of which in the manufacture of various parts of motor cars and aeroplanes may be envisaged. So is the scope of shellac for use in water-proof abrasive papers, artificial leather, book-binding cloth, oil-cloth, grinding wheels, stoving enamels and lacquers, of which large quantities are now being imported into this country.

As the use of electricity spreads into smaller towns and villages, and radio becomes more popular, the use of lac would multiply *pari passu*. The unique raw material, mica, which is so far exported into foreign countries, may then form the basis of an independent permanent industry in this country. In short, all the above industries arising out of the recent researches on the utilisation of lac, may be expected to be established on a sound basis in the post-war period.

In the appendix is given a comprehensive list* of the known uses of lac products which will indicate how versatile lac is for industrial applications.

Without going into further details, it may be emphasized at this point how important both fundamental and technical researches on lac are to ensure its large-scale application now and after the war. Every new application leads to further consumption of this unique resin and one could, in short, state that the share of this natural commodity in big industries will be determined by the already known properties of lac as also future modifications that may be brought about by intensive research.

The consideration of an economic price level for this resin is probably one of the most important to keep this material on the map; for, it must be admitted, that for the disposal of quite a considerable portion of the lac produced, we have as yet to look for export into other countries. So far, the cheaper synthetic resins may be priced at 9*d.* to 1 *sh.* per pound and to secure a progressive trade in shellac, after allowing for its various qualities above the synthetics as also its deficiencies in comparison with them, its (shellac) normal price should be of the order of 6 to 8 annas per pound, that is to say, Rs. 30 to Rs. 40 per maund. No doubt such prices have been available for shellac, but during the few years before this war the price of shellac reached a level as low as Rs. 14 per maund. The law of supply and demand must have mainly operated to bring down the price of shellac to such an uneconomic level, but with increased use of lac in newer industries there is the chance of an ever-widening field for its production and maintenance of a reasonably profitable price of Rs. 30-40 per maund in competition with the synthetic resins.

A question has often been asked: Is it possible to increase the production of lac to the same tune as the synthetics? To that the answer is: At present 40-50 thousand tons of lac are being annually produced as against 150-200 thousand tons of synthetics. *With a reasonably attractive price for lac*, it will be possible to reach this figure for synthetics in ten years. Some very interesting work of the Entomological Section of the Indian Lac Research Institute has already shown that by slight modification of the existing method of lac cultivation, about a third more of lac can be produced. The indiscriminate cutting down of *Ari* lac (immature lac) due to the poverty of growers, if once stopped by co-operative loans, would enable the growers to bring more trees under infection resulting in increased output. New cultural methods like artificial defoliation before the natural leaf-fall begins and partial pruning in early spring can considerably improve the yield of lac on trees carrying a crop.

As further researches enable us to have a real glimpse into the structure of shellac, it may be hoped that its constituents would be the starting material for new synthetic products and the now-forgotten dye, as far as signs show, may be the source of pharmacologically active preparations. During the War of 1914-18, it was feared that in the post-War period the demand for shellac would decrease due to the advent of synthetic resins, but curiously as mentioned before this did not happen. There is no reason, therefore, to anticipate any retrogression after the present war, more so, as newer avenues of the uses of lac are being opened up through the experiences of the present war. An industry the annual export value of the products whereof has been of the order of 4·6 crores of rupees on an average for 21 years, deserves more careful handling in the field as well as in the laboratory.

APPENDIX

The Known Uses of Lac Products

A. Shellac Varnishes

(*a*) *Spirit and Alkali Varnishes*:—

I. Insulating varnishes and impregnating compounds—
1. To prevent copper wire "greening": Hard lac—alcohol; Shellac—*p*-toluene sulphonamide.
2. To resist effect of lubricating oils and greases: Shellac—alcohol; Lac—glycol ether in solvents.
3. In micanite and micafolium: Shellac—alcohol (dry powdered lac).
4. (i) In building up paper and fabric tubes and impregnating tape and fabrics: Shellac—alcohol; Shellac—glycol ether; Hard lac resin and alcohol; (hot spraying of dry powdered lac). (ii) Greaseproof paper: Bleached lac—alcohol.
5. To resist high temperature: Shellac—glycol ether and alcohol.
6. For brake linings: Shellac in solvents; Hard lac resin in solvents; Shellac—tung oil varnish.

II. Shoe Trade—
1. Shellac stiffeners for toe and soles of shoes, etc.: in alcohol solutions; in ammonia solutions.
2. Shellac varnishes and finishes: in alcohol solutions; in ammonia solutions; in borax solutions.

III. Leather Trade—
Pigmented and unpigmented shellac finishes: in alcohol; in ammonia; Shellac—stearic acid compound; Shellac—metallic oxides and alcohol.

IV. Hat Industry—
Felt and fur hats, service hats and helmets: Shellac and bleached lac: in alcohol solutions; in borax solutions; in other alkaline solutions.

V. Photographic Industry—
1. Negative varnish: Shellac—alcohol.
2. Anti-halation plate and film backing: Soft lac resin in alkali solution; Hydrolised lac in alkali solution.
3. Dry mounting paper: Paper tissue impregnated with: Bleached lac—alcohol solution.
4. Preparing photographic graticules: Shellac solutions.
5. Photosensitizing processes: Cold tops in photo-engraving and etching; Shellac—

* "The Story of Lac," A. J. Gibson, *Journal of the Royal Society of Arts*, 1942.

alcohol; Hard lac resin—alcohol; Shellac in aqueous ammonia and ammonium dichromate.

6. For protecting sound tracks on "talkie" films: Dewaxid shellac—nitro-cotton and solvents.

VI. Protective coatings for wood, paper, metal, and fabric—

1. French polish: Shellac—alcohol; Hard lac resin—alcohol; Shellac—metallic oxides and alcohol; Bleached lac—alcohol; Shellac—urea and alcohol; Shellac—alcohol—ammonia.
2. In medicine: For semi-rigid bandages; for coating pills; Shellac in alcohol.
3. In confectionary: Glazing candies and chocolates; Shellac in alcohol; Bleached lac in alcohol.
4. For burnishing coffee beans: (Dry powdered shellac).

VII. Polishes and finishes generally—

1. Shellac—esters: Rosin-shellac ester in turpentine and white spirit; Shellac—stearic acid ester as above.
2. Shellac—sodium bisulphite: for distempers; for coatings resistant to petrol.

(*b*) *Shellac Varnishes: Other Types*:—

1. For spraying: Cellulose nitrate—shellac and alcohol plus other solvents; Ethyl cellulose as above; Bleached lac as above; Dewaxed lac as above.

(*c*) *Shellac Oil Varnishes*:—

1. For general application: Shellac—drying oil—fatty acid—glycerol; Shellac esters—mono- and polyglycerides—drying oils.

(*d*) *In Inks*: Waterproof ink; Coloured inks; Lithographic inks; Shellac in alkali or alcohol solutions with other materials.

(*e*) *In Paints*: Antifouling compositions: Road paints: Solutions of shellac with other materials, poisons, pigments, etc.

B. Shellac Cements and Adhesives

1. For glass to glass, glass to metal, metal to metal, etc.

Cements:—Dekhotinsky cement: Shellac—pine tar; Pettman's cement: Shellac—Stockholm tar; Laboratory cement: Shellac—Venice turpentine; Shellac—lac-glycol ester; Electric bulb cement; Shellac—marble powder-zinc oxide and alcohol.

Adhesives:—Shellac—tartaric acid and alcohol; Shellac—rubber latex and ammonia; Shellac rubber and solvents; Dewaxed lac—lac glycol ester.

2. For abrasive wheels, emery paper, blackboard surfaces: Shellac—alcohol. Hard resin—alcohol; Hard lac resin—urea and alcohol.
3. Sealing wax: (i) As such: Shellac with fillers; Bleached lac with fillers. (ii) In turnery and toys: Shellac and colouring media; Coloured dry lac, in sticks.
4. Optical instruments: Shellac in alcohol; modified lacs.
5. Semi-rigid and flexible cements: To resist various solvents: modified lacs; Shellac—lac acids and glycol ester.
6. For rubber manufactures: (1) Rubber soles and heels; (ii) Rubber sheet: modified lacs and shellac; (iii) for rubber surface lacquers: Lac glycol ether with nitro-cellulose in solvents.

C. Shellac Mouldings

For Gramophone Records; 46 Electrical uses; Dominoes; Draughtsmen; Dental plates; Shellac in various forms: (1) Open moulding; (ii) Closed moulding; (iii) Injection moulding.

Shellac, hard lac resin and modified lacs in combination with: Stearic acid; Fillers, micronized mica; Phenol formaldehyde; Formaldehyde; Urea; Melamine; Protein; Cashewnut shell oil; Jute.

D. Other Uses

Bengal and signal lights and rockets; Pyrotechnics generally; in foundry work; Playing cards finish; Stiffening crepe; American cloth, Waterproof silk and sou' wester finishes; Sweets and cheese metal foil finishes; Hard lac resin in alcohol.

Tank steamer coatings: Shellac; Hard lac resin; Modified lacs.

Lac products as starting materials for synthesis:—Cosmetics: Hair dyes; Fingernail polishes. Shellac in solvents; Hard lac resin in solvents.

E. Bleached Lac (48)-(50)

Seedlac or shellac dissolved in alkali, bleached with chlorine precipitated with acid, washed and dried and sold in powder or hanks.

Used principally in categories A, B and D of the chart. Annual production 7,000 tons, principally American; Bleached hard lac resin; Bleached soft lac resin.

"The history of research is full of men who duplicated Columbus' experience of hunting for a trade route and finding a continent. It was through effort to create synthetic rubber that the quick-drying lacquers, which have meant so much to the automobile industry, were developed. J. W. Hyatt started experiments to produce synthetic billiard balls, but accidentally developed a material for making non-wilt collars and cuffs instead. Then Doctor Baekeland came along with an idea for synthesizing phenol and formaldehyde, but developed a material which makes the ideal synthetic billiard ball, through the discovery of *Bakelite* phenolic resinoids. Acheson started out to improve the production of graphite, cooked some coke and sand together, and produced silicon carbide instead. In our own work on fuels, it was an incorrect theory that led us directly to the discovery of the first anti-knock compound, iodine, and later put us on the right track to tetraethyl lead. The point I want to make is that though you end up one hundred and eighty degrees from the thing you may have aimed at, you do end up with something, if you keep working."—(Charles F. Kettering in "Prospecting for Knowledge" in the *Bakelite Review*, Jan. 1942.)